

# STANDARD SPECIFICATION FOR HIGH MAST LIGHTING SYSTEM

## 1.0 INTENT

The intent of this specification is to define the requirements for the supply, manufacture, erection, testing and commissioning of the high mast lighting system.

## 2.0 DESIGN CRITERIA

The mast shall be designed in a manner so that is capable of withstanding the forces exerted on it by maximum wind speeds & stresses specified in IS-875, 1987.

The resonant frequency of the mast shall be less than 1 Hz so that wind speed stresses which arise at resonance are correspondingly low.

## 3.0 GENERAL REQUIREMENTS

### 3.1 Construction:

The mast shall be manufactured from mild steel plate, cut and folded to form continuously tapered polygonal profile. The 20 meters mast shall comprise of two sections of approx. equal lengths. Each mast section shall not have any circumferential welding joint.

Sections should be fitted together on site, telescopically, in a manner that does not require additional welding; nor are bolted joints acceptable. The minimum overlap distance shall be 1.5 times the diameter at penetration. The dimensions of the mast shall be decided based on proper design and design calculations shall be submitted for approval. Steel (grade-434) confirming with IS-22, 1975 / BS-4360 shall be used for the construction of the mast and welding processes shall confirm to BS-5135 and mast shall be hot dip galvanized internally & externally confirming to BS-729 / IS-4759, 1984. The mast structure shall be designed for an assumed maximum reaction arising from the maximum wind speed (3 seconds gust), likely to be exceeded only once in 50 years (180 km per hour) and measured at a height of 10 mtrs above ground level. The design life of the mast shall be minimum 25 years. Wind excited oscillation shall be damped by the method of constructions and adequate allowance made for the related stresses.

### 3.2 Foundation:

The foundation shall be of RCC, M20 minimum 2M X 2M in plan size and shall be minimum 1 meter below NGL or FGL whichever is lower. The foundation shall be designed as per the soil bearing capacity (SBC) of the proposed site.

### 3.3 Base flange:

The mast shall be provided with fully penetrated flange, which shall be free from any lamination or incursion. The welded connection of the base flange shall be fully developed to the strength of the entire section.

The base flange shall be provided with supplementary gussets between the bolt-holes to ensure elimination of helical stress concentration. Sufficient numbers of holding down bolts of high tensile strength shall be supplied complete with sufficiently thick anchor plates for casting into the foundation. The precision made steel template with tube holes shall be provided to ensure correct verticality and horizontality of bolt alignment.

### **3.4 Base compartment:**

An access opening of the base compartment with door provided and should be suitably reinforced to maintain the strength of the mast such that undue buckling of the cut portion or buckling of the mast section under heavy wind conditions is prevented. The opening shall be such as to permit clear and easy access to equipment like winches, cables, plug and socket, etc. and also facilitate easy removal of the winch. The door should be weatherproof type with suitable locking arrangement.

### **3.5 Earthing terminal & earthing:**

Stainless steel hexagonal head bolt, complete with saddle bracket should be located in readily accessible position in the base compartment to be used for earthing terminal. Proper double earthing shall be provided to the tower. Feeder pillar shall be independently double earthed.

### **3.6 Head frame:**

The head frame, designed to be capping unit of the mast shall be welded steel construction and hot dip galvanized. The pulleys for the hoist rope and electrical supply cables shall be of non-corrosive material. Pulleys made of synthetic material such as Plastic or PVC are not acceptable. Self-lubricating bearings and stainless-steel shaft shall be provided. Close fitting removable guards shall be provided over the pulleys to ensure correct location of the ropes and cables in their grooves during operation. The pulleys are housed in a chassis integral with a sleeve which slips over the top of the mast and is secured axially and in azimuth. Guides and stops are provided for docking the lantern carriage. The complete chassis assembly is hot dip galvanized after fabrication. The whole head frame assembly shall be covered by a weather proof hot dip galvanized canopy and secured to the frame by stainless steel bolts.

### **3.7 Lantern carriage:**

The lantern carriage shall be of double ring and of mild steel construction and shall be hot dip galvanized after assembly. The carriage shall be in the form of a double ring fabricated in two/three halves and joined by bolted flanges with SS bolts & nuts enabling it to be assembled or removed from the shaft after erection. The lantern carriage shall be so designed and fabricated to hold the designed flood light fittings, control gear boxes, junction boxes and also have a perfect self-balance. The inner lining of the carriage shall be provided with protective buffer arrangement to prevent damage to the mast finish

during raising/lowering operation of the carriage. The diameter of the lantern carriage shall be sufficient enough, but not less than 4 Ft. so as to hold designed number of flood light fittings, as specified in the tender design along with control gear boxes and lantern.

Suitable provision shall be made at the base compartment of the mast to facilitate the operation of internally mounted, electrically operated power tool for raising and lowering of the lantern carriage assembly.

### **3.8 Electrical junction boxes:**

Junction boxes suitably located and housing connections to the lantern shall be provided to meet the design requirement to feed the lightings. The junction boxes shall also have provision for connection of the flexible mast electric cable. The junction boxes shall be constructed so as to ensure complete protection against weather. The aviation light fittings will also be fed through the junction box.

### **3.9 Wiring duct:**

Suitable wiring duct shall be provided which should carry electric wiring to the light fittings.

### **3.10 Electric cables:**

A suitable terminal box shall be provided as part of the contract at the base compartment of the high mast for terminating the incoming cable. The electrical connections from the bottom to the top shall be made by special trailing cable. The cable shall be EPR insulated and PCP sheathed to get flexibility and endurance. High mast shall be provided with flexible, round, multi-core, copper conductor power cable with minimum 2nos.of spare cores. The cable shall be suitably sized to ensure proper flow of current with voltage drop within permissible limit (described elsewhere in the tender document).

### **3.11 Electrical disconnect:**

An electrical disconnect shall be provided at the base of the mast, comprising socket with coupling ring and threaded plug. It shall be possible that for lowering the lantern cartridge, the electrical cable is disconnected at the base and connected to the test lead so that it is free to travel within the mast and power supply can be maintained.

### **3.12 Winches:**

The mast shall be provided with double drum winch. The winch will be completely self sustaining type, without the need for brake shoe, springs or clutches. The winch shall be capable of handling maximum anticipated load with sufficient safety margin. Suitable reduction gear box shall be provided which shall be filled with lubricant in the factory and should require no further attention at site. The gears shall be with suitable reduction ratio and provision shall be made both for manual as well as power drive (independent of each other).

The drum shall be fabricated from steel. To ensure correct rope stacking, a minimum of one full layer of rope shall remain on the drum,

after the lantern carriage has been lowered to its lowest position. The double drum winch shall use an arrangement of minimum two independent ropes and each rope shall have one end clamped to the winch drum and the other end attached to the lantern carriage. Alternatively, provision of transition plate with locking arrangement inside shaft axis with the lantern carriage supported /suspended by three wire ropes is also acceptable. The control arrangement shall allow for normal operating duty of raising and lowering of the lantern carriage assembly. Additionally, a separate manual only function shall permit for fine adjustment of lantern carriage for levelling and docking of the carriage. Automatic gravity latches, which separately lock each drive shaft when not in use will also be provided.

A test certificate shall be furnished by the contractor for each winch in support of the maximum load operated by the winch. The capacity, operating speed, safe working load, recommended lubrication and serial number of the winch will be clearly marked on each winch with an indelible label.

### **3.13 Stainless steel wire rope:**

All wire ropes shall be made from stainless steel confirming to IS-2365, 1963 & IS-3457, 1977 having a tensile strength of 165 Kgf / mm & breaking load of min. 2400kg. giving a factor of safety of over 5 for the system at full load. The S/S rope shall have a construction of 7/19, with a min. diameter of 6mm. to combine corrosion resistance with flexibility. There shall not be any intermediate joints on the ropes, unless for provision of transition plate with safe locking arrangement in shaft axis.

### **3.14 Essential tools for operation:**

#### **A) Power drive:**

A suitable, high-powered, electrically driven, internally mounted power tool, with manual over-ride shall be supplied for the raising and lowering of the lantern carriage for maintenance purposes. The power tool shall be single speed, provided with a motor of the required rating. The capacity and speed of the electric motor used in the power tool shall be suitable for the lifting of the design load installed on the lantern carriage. The power tool mounting shall be so designed that it shall be not only self supporting but also aligns the power tool perfectly with respect to the winch spindle during the operations.

The control for the power tool shall comprise of incoming MCCB isolator of suitable rating, copper wiring, suitable timer, contactor to switch on the luminaries at a pre-set time. There shall be suitable control arrangement to change the direction of rotation of the power tool motor. The complete electrical control has to be suitably housed with proper access for maintenance. A remote controls switch to be provided with suitable length of cable to allow the operation of the equipment from a safe distance of 5 meters.

The power drive shall be connected to the winch via a matching coupler. To protect the hoist rope system against overload, the coupler shall incorporate a torque limiting clutch, pre-set at the factory. The torque limiter shall trip the load when it exceeds the adjusted limits. There shall be suitable provision for warning the operator once the load is tripped off. Electrical over load tripping of the power tool with visual indication of motor tripping is also acceptable, alternatively.

**B) Test lead :**

Flexible multi-core test lead shall be identical to the electric cable specified earlier. The conductor core shall be insulated with ethylene propylene rubber and the complete cable core shall be matching with the main electric cable. Each test lead shall be provided with locking type male plug at one end and female plug at the other end.

**C) Winch winding and adjusting handle:**

For manual operation of the winch drum and for minor adjustment of the lantern carriage, suitable handles shall be supplied.

**3.15 Lightning protection:**

Lightning protection shall be provided to the high mast. All material supply / erection for lightning protection shall be in contractor's scope.

**3.16 Aviation lights:**

Aviation lights (twin type) shall be provided with suitable wiring as per DGCA guidelines.

**3.17 GENERAL:**

The high mast tower(s) shall be located only in non- hazardous and safe areas.

Type of luminaire : Flood-light with 2 x 400W HPMV or 2x350 W LED lamps.

Make : Philips / Crompton / Bajaj.

No. of luminaries : 08 / 12 Nos. for 20 m and 30 m HM respectively.

The light fittings with the control gear boxes shall have minimum IP-55 protection.

**4.0 INSPECTION & TESTING**

Inspection & testing shall be following the criteria mentioned under "Inspection & testing philosophy" in the 'Electrical scope of work' in bid package.

All routine tests according to the relevant Indian standards shall be carried out and copies of certificates shall be submitted for approval.

Main acceptance tests shall be as follows:

- a) General visual inspection
- b) Dimensional inspection
- c) Verification of mechanical and electrical operations.

## 5.0 DRAWINGS & DOCUMENTS

The offered high mast shall be of proven design. The design drawing and illumination distribution diagram shall be submitted to OIL for approval along with manufacturer's test certificates for following:

- a) Steel plates used for the fabrication of mast.
- b) Steel wire rope.
- c) Winch.
- d) Hot dip galvanizing.

Purchaser's approval of contractor drawings and certifying test results shall not relieve the manufacturer of his responsibility for supplying equipments conforming to relevant standards or for any mistake, omission or commission in manufacturer's drawings.

## 6.0 TRANSPORT AND SHIPMENT

Transport and shipment of items will be contractor's responsibility. Contractor need to follow the instructions for the same detailed under the 'Electrical scope of work' in bid package.

## 7.0 WARRANTY

The warranty for the items will be as mentioned under "Warranty" in the 'Electrical scope of work' in bid package.